GateMate

Remote Rice Farming

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Problem

- Rice
  - Provides 21% of global human per capita energy
  - Provides 15% of per capita protein
  - US rice production exceeded $3 billion

- Alternate Wetting and Drying
  - Labor intensive
  - Prone to human error
  - Time consuming
  - Errors lead to lost yield, lost profit, and wasted water

- Growing strain on natural resources

Solution

- Mobile interface to raise and lower gates remotely
- Assist with the initial gate placement
- Automatically raises and lowers gates according to
  - Weather
  - Crop life cycle
  - Growth rate of the crop

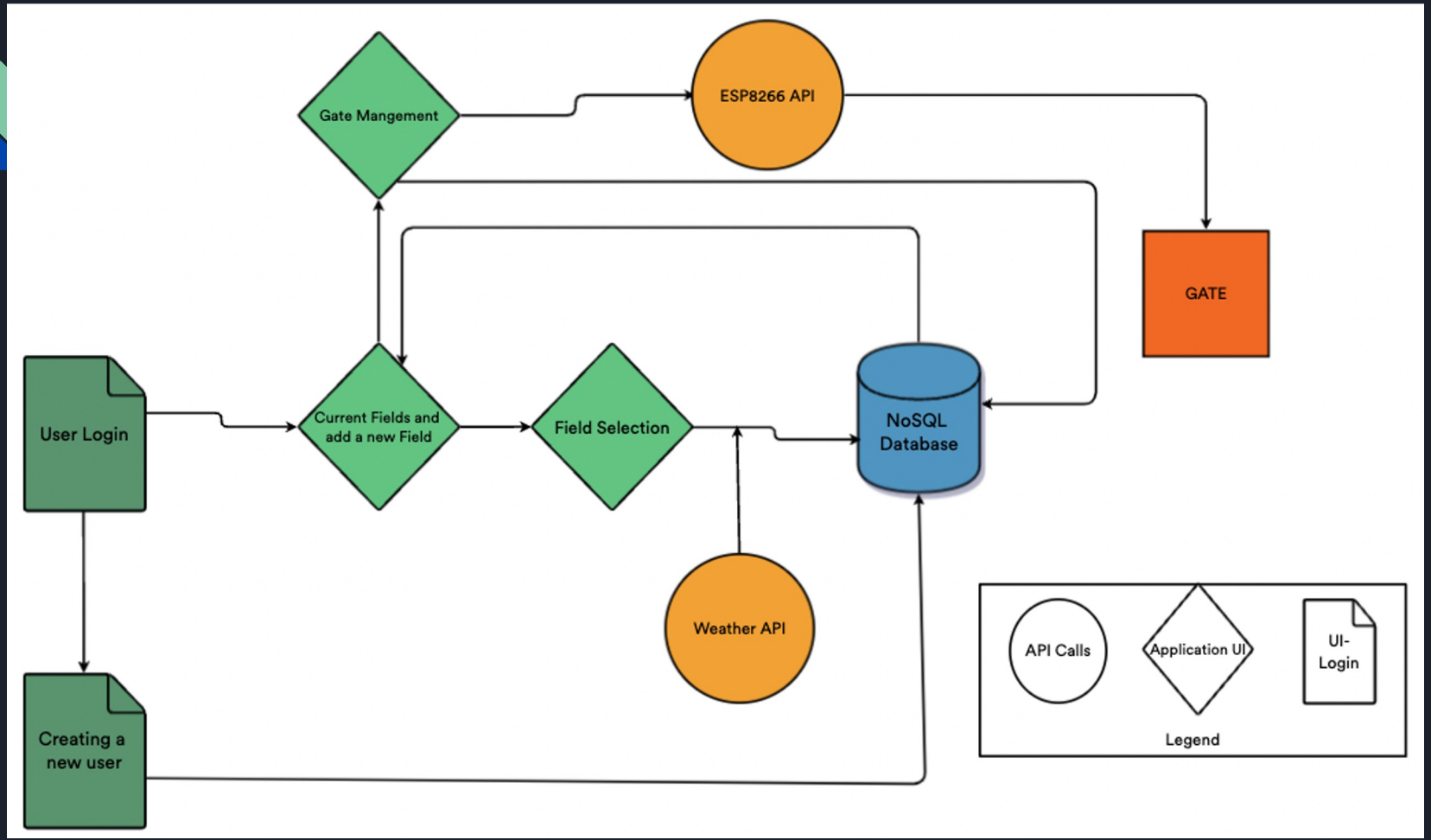
Central Server and Database

Mobile Application

Gates

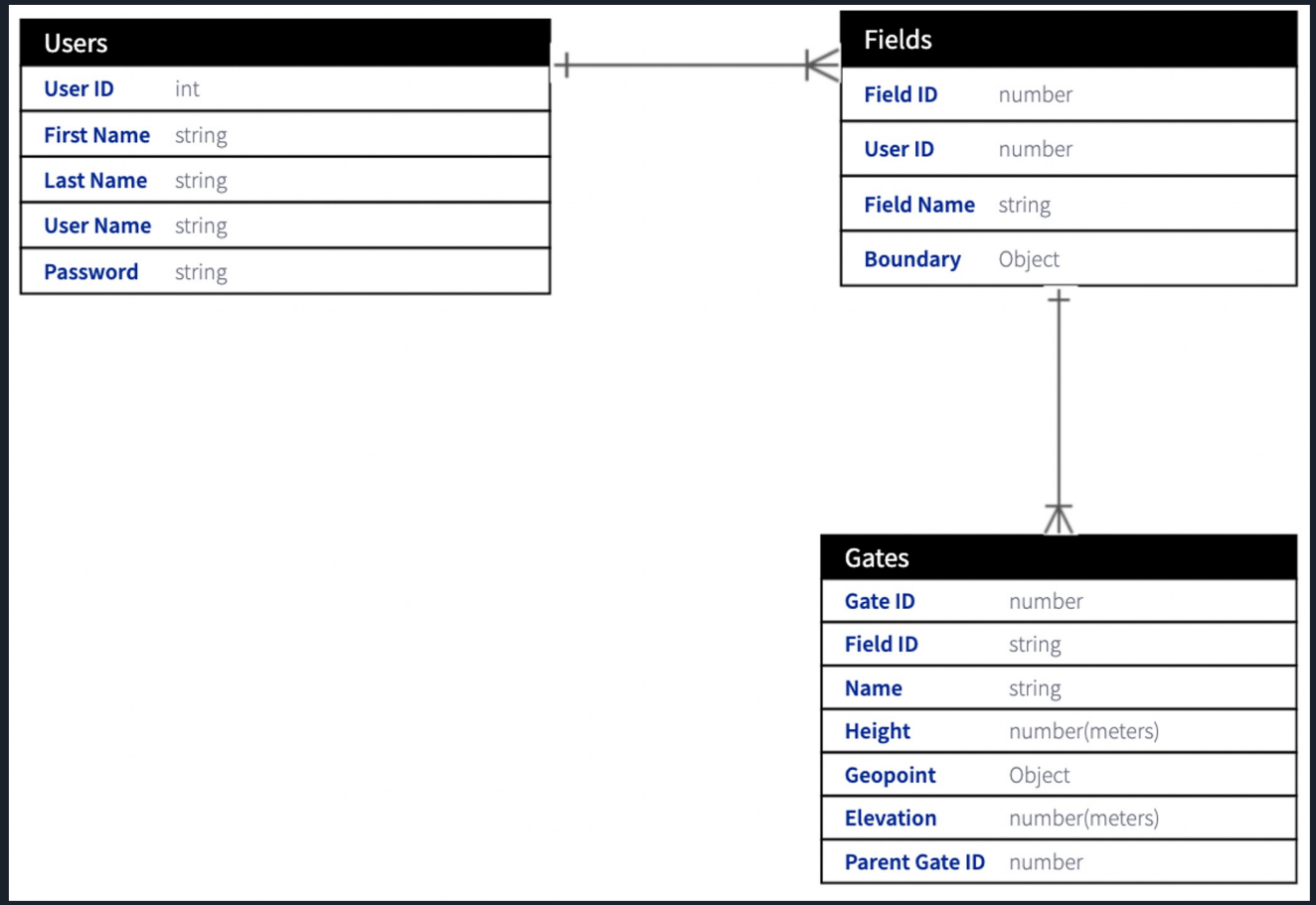
Wi-Fi Mesh

https://icons8.com

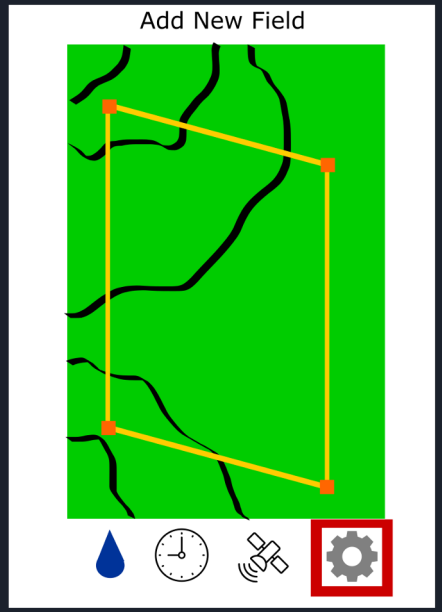

Gate Mangement
ESP8266 API
GATE
User Login
Current Fields and add a new Field
Field Selection
NoSQL Database
Weather API
Creating a new user
API Calls
Application UI
UI-Login
Legend

Schema

```
"users"=
{
  "id": {},
  "user_name":,
  "first_name":,
  "last_name":,
  "password":,
  "fields": [
  {
    "id":,
    "field_name":,
    "boundary": {
      "geopoint_1:": {
        "longitude": ,
        "latitude:":
      },
      "geopoint_2:": {
        "longitude":,
        "latitude":
      },
      "geopoint_3:": {
        "longitude":,
        "latitude":
      },
      "geopoint_4:": {
        "longitude":,
        "latitude":
      }
    }
  },
 ]
}
```

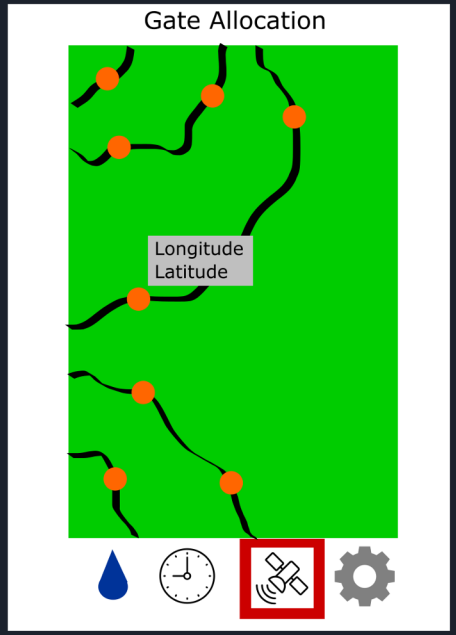


Manually-Drawn Field User Interface



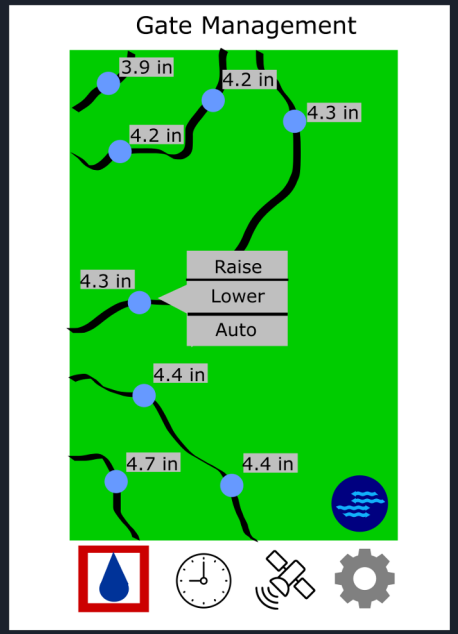
- Allow users to manually draw fields
- Store field location information to user account

Gate Allocation User Interface



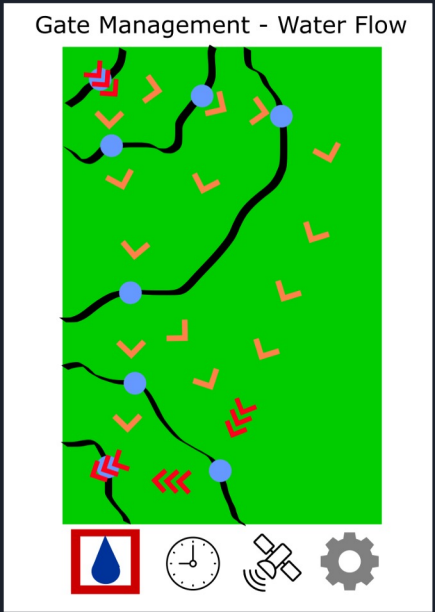
- Display optimal gate placements
- Clearly demonstrate placement reasoning
  - E.g., displaying a topographic view, showing water flow (discussed later)

Gate Management User Interface



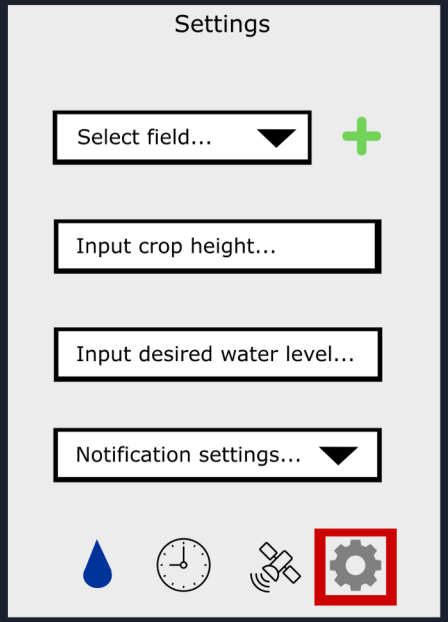
- Current water levels
- Finely tune gate heights
- Visualize gate locations

Water Flow User Interface



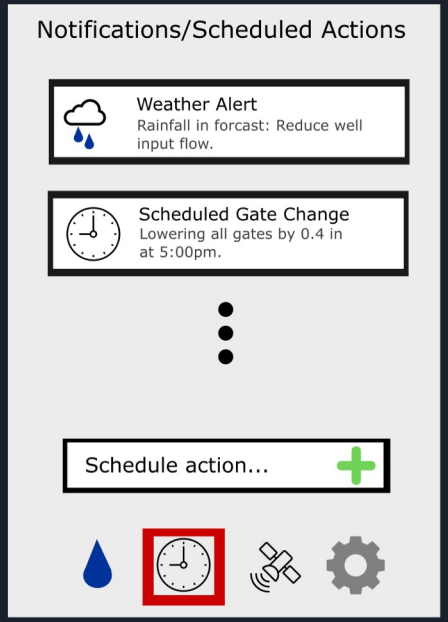
- Show path of least resistance for water
- Note places where water may be leaking from the field

Application Settings User Interface



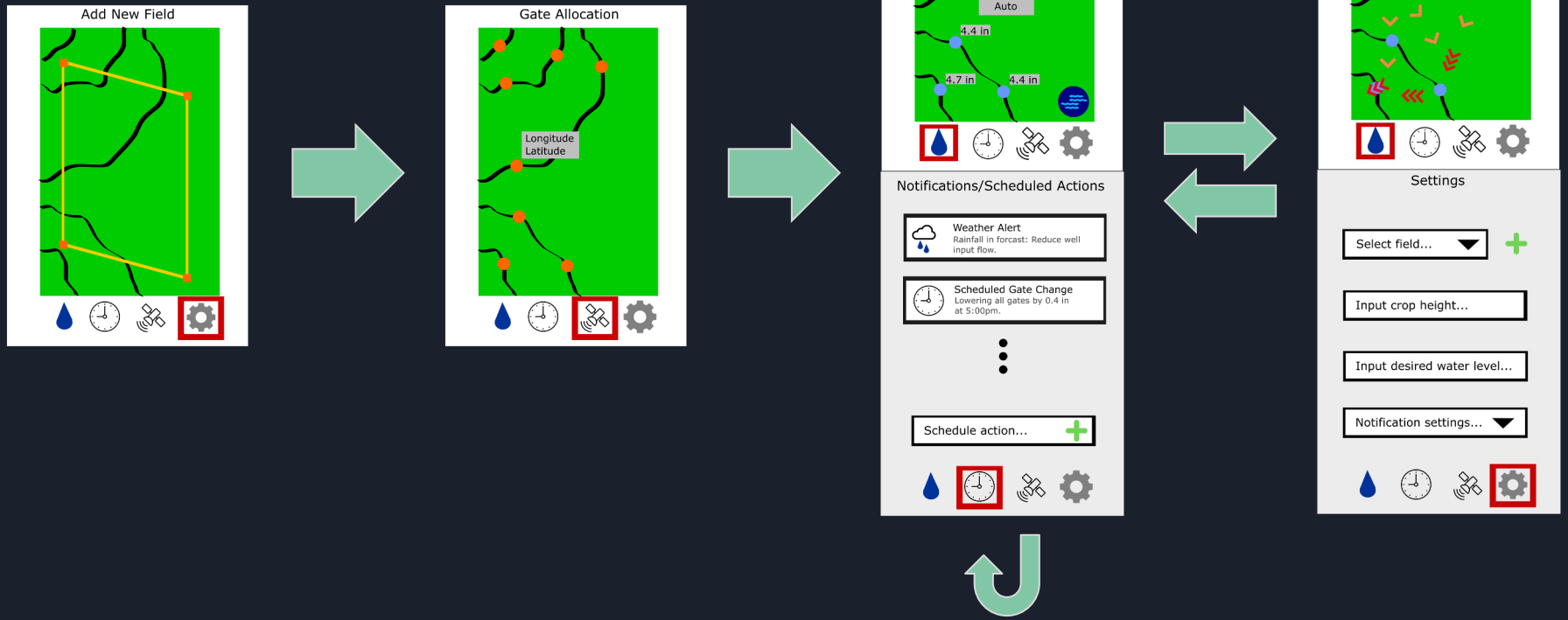
- Presents options to:
  - Select field if user manages multiple
  - Input measured crop height
  - Input desired field-wide water levels
  - Manage notification settings

Notifications/Actions User Interface



- Notify user of weather that affects gate height
- Inform user on general gate behavior
- Notify user if a gate goes offline
- Show pending gate-management actions
- Allow scheduling of actions

Use Flow


Add New Field
Gate Allocation
Longitude
Latitude
Gate Management
3.9 in
4.2 in
4.3 in
4.2 in
4.3 in
Raise
Lower
Auto
4.4 in
4.7 in
4.4 in
Notifications/Scheduled Actions
Weather Alert
Rainfall in forcast: Reduce well input flow.
Scheduled Gate Change
Lowering all gates by 0.4 in at 5:00pm.
Schedule action...
Gate Management - Water Flow
Settings
Select field...
Input crop height...
Input desired water level...
Notification settings...

Deliverables

- Design and usage documentation
- React Native-based, front-end mobile application
- Central server software
- Database schema and sample data
- Gate microcontroller software
- Final report